How to install and operate the **DLS CAT31** 24 V amplifier

Welcome!

This owners manual is written in easy english and uses a lot of drawings to simply the installation and use of the above amplifier.

Your DLS amplifier must be installed correctly in order to work well. This manual will show you how to install the amplifier like a pro. Please read the entire manual before beginning the installation.
Install the amplifier yourself if you feel confident with our instructions and if you have the proper tools. However if you feel unsure, turn over the installation job to someone better suited to it.

Warranty Service

This amplifier is covered by warranty, depending on the conditions in the country where it is sold. If the amplifier is returned for service, please include the original dated receipt with the product.

Technical Assistance

For technical assistance ask the shop where the product was sold or the distributor in your very country.
You can always phone the DLS Helpdesk in Sweden + 46 31 84 00 60 or send an e-mail to info@dls.se.
Information can also be found on our WEB-site www.dls.se

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Approval of electromagnetic compatability according to the EEC Directive 95/54/EC

CE

DLS Svenska AB - 2007-01-10

CAT31 -24 Volts - features

- RCA stereo channels input
- High level input with auto start
- Mono channel: RCA input or input from stereo channels
- Continuous variable low pass crossover
- Continuous variable high pass crossover
- Subsonic filter 25 Hz fixed ON-OFF
- Phase control cont. variable 0-180 degrees
- Electronic protection circuitry against short-circuit, DC offset and thermal overload.

Installation

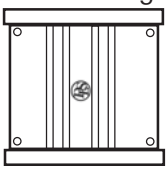
Before you begin the install

Before you begin you need to read the manual, to have some tools, cables and other material available. There is one such list of material on the following page.

Amplifier location

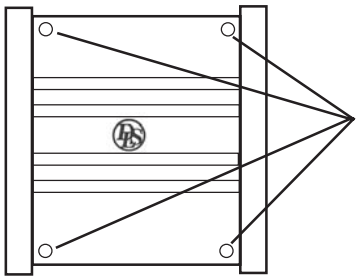
Important
Allow air circulation around the amplifier.

The DLS Classic series of amplifiers have a compact design that allows great flexibility in mounting. You can mount it under a seat or in the trunk.
When you select a location, do remember that the amplifier generates a lot of heat.
Choose a location where air can circulate freely around the amplifier. Do not cover the amplifier with carpets or hide behind trim panels.
Do not mount the amplifier in an inverted or upside down position.
Check all locations and placements carefully before making any cuts, drilling any holes or making any connections.
This is the best direction to mount the amplifier to get the best cooling.



Removal of side flanges

In order to fasten the amplifier to the surface and connect speaker and power cables, the flanges on the sides must be removed. This is done by loosening the hex screws on top of the amplifier. Use a 3 mm hex key.



Remove these screws using a 3 mm hex. key for removal of side flange. Remount after fastening the amplifier and connection of the speaker and power cables.

Trouble shooting

If problems occur during the installation, or later, this guide might help you to find out whats´s wrong.

The amplifier is dead:

1. Check power lead, ground and connections at the amplifier using a multi meter.
2. Check the battery terminal connections.
3. Check the power lead fuse or circuit breaker. If fuse damage continues, inspect the power lead for short circuits.
4. Check the amplifier protection fuses. Are these broken change to new ones with the same value. If short circuiting continues, contact your local DLS dealer. A fault may exist in the amplifier.
5. To start the amplifier requires a remote voltage of 12-30 volt. Check the voltage with a multi meter.

Amplifier protection fuse blows at low volume:

One or more speaker cables are shorted. Make an insulation test with a multi meter. The cables must not have a connection to earth.

The amplifier turns off after 10-30 minutes:

The amplifier is overheating due to inadequate ventilation. Check mounting position is free from obstruction.
Do this:
1. Move the amplifier to a place with better ventilation.
2. Install one or two fans to cool down the heat-sink.
3. Overheating can also be caused by an impedance load below the level permitted.

No output from the speakers:

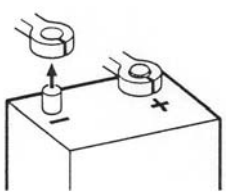
Check the following:
1. Speaker cable connections to both amplifier and subwoofers.
2. Signal lead plugs and cables.

DLS logo on amplifier cooling flange

The DLS logo on top of the amplifier is attached with two hex. screws. The logo can be removed and twisted 90 or 180 degrees, and then screwed back in wanted position. The logo can be mounted in four different ways to match your installation.

Disconnect Battery

Before starting the installation, always disconnect the negative terminal of the battery.



Tools and material needed

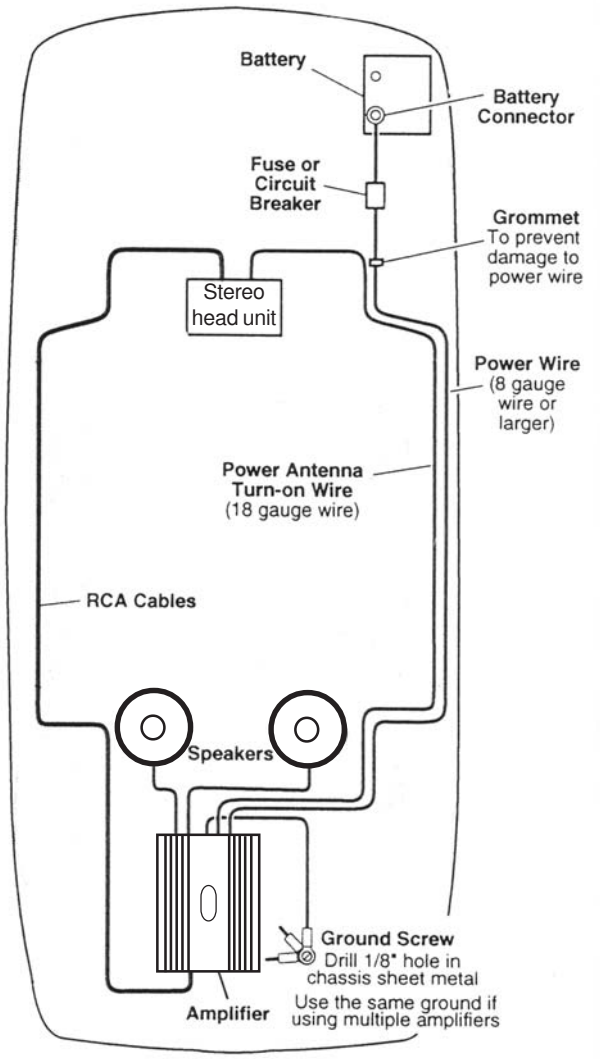
Tools:
- Flat and Phillips screwdrivers
- Wire cutter
- Wire stripper
- Electric drill with drills
- Crimping tool
- Digital multimeter or test lamp
- Wire brush, scraper or a piece of an abrasive sheet to remove paint for a good ground connection
- Grease to protect the ground connection from corrosion

Material:
- Speaker wire: minimum 12 AWG = 4 mm² for subwoofers
- Sheet metal screws for mounting the amplifier to the amplifier board and the amplifier board to the car + some extra for fuse holder, amplifier ground etc.
- Electrical insulation tape
- ½ inch thick plywood or particle board for the amplifier to be mounted upon.

Amplifier installation kit:
If available,buy an amplifier installation kit. It contains normally all you need. This is what you have to buy if you buy the items separately.

- Power cable, AWG 7 = 10 mm² or heavier
- 1 pc of fuseholder to install close to the car battery + fuse 40 Ampere.
- 20 feet of AWG 15 = 1,5 mm² wire for remote turn on / off cable from radio.
- RCA-cable for input from radio.
  - 20 feet or 5 meter for trunk installations
  -12 feet or 2 – 3 meter for under seat installations
- One min. 8 gauge ring crimp terminal for the amplifier ground connection.
- Wire ties
- Insulating grommet or insulating tube

Routing wires


Battery
Battery Connector
Fuse or Circuit Breaker
Grommet To prevent damage to power wire
Stereo head unit
Power Wire (8 gauge wire or larger)
Power Antenna Turn-on Wire (18 gauge wire)
RCA Cables
Speakers
Ground Screw
Drill 1/8" hole in chassis sheet metal
Use the same ground if using multiple amplifiers
Amplifier

High current draw

The CAT31-24 Volt is an amplifier with high power output. The current draw is also high so you must make sure that your vehicles power system (battery and alternator) can provide all the power you need. If you have a bad battery or alternator in can result in a poor sound or even worse, a broken battery or alternator.

Professional Tip:

If amplifier installation kits are available with diffe-rent size of power cable, chose the most heavy power cable to improve sound quality and to allow more amplifiers to be installed now or later.

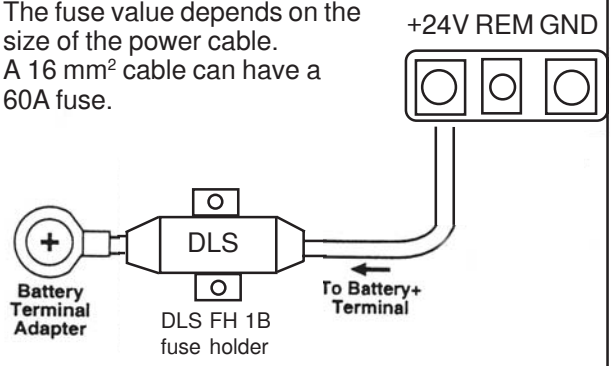
If possible buy AWG 5 = PL 16 mm² (or heavier) cable for best performance.

Wiring

Power and Outputs

Power terminal (+24V)

Connect the fuse holder as close to the vehicle battery + as possible, using AWG7 = 10 mm² or heavier cable. Use ring crimp terminal cable to connect to battery +. Apply silicon grease to the fuse to prevent corrosion.
The fuse value depends on the size of the power cable.
A 16 mm² cable can have a 60A fuse.



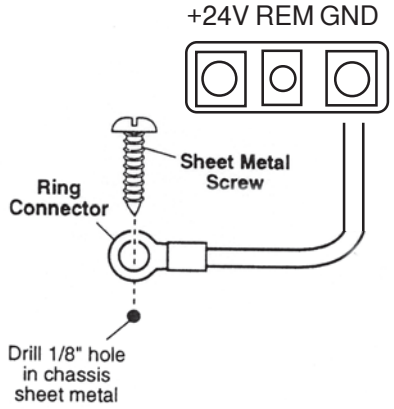
Connect the battery cable to the +24 Volt terminal on the amplifier.
Be sure to use a rubber grommet or a plastic insulating tube where the cable passes the firewall or other places when it can easily be jammed.
Use wire ties to secure to existing cables in the engine room. If you buy another power cable than the recommended, use the follwing maximum fuse values.

Max. fuse value for different cable sizes:

6 mm² (9 AWG) :25 A	10 mm² (7AWG) :40 A
16 mm² (5AWG) :60 A	21 mm² (4AWG) :100 A
33 mm² (2AWG) :150 A	42 mm² (1AWG) :200 A

Ground Terminal (GND)

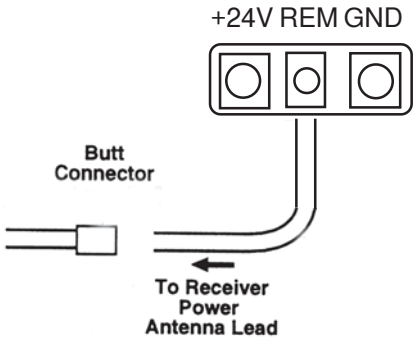
Connect to a good chassis ground. The ground connection should be clean, unpainted metal to provide a good electrical connection. Use a wire brush, a scraper or a piece of an abrasive sheet to clean the metal. Use a lock washer or two to secure contact. Protect with silicon grease or by paint applied afterwards.



Remote terminal (REM)

For RCA cable signal input:
Connect the radio power antenna lead = remote turn on/off from the car stereo to the amplifier remote connection. This turns on the amplifier whenever the car stereo is turned on.
You can either use the built in remote cable in the RCA cable itself or use a separate cable.
Sometimes a small disturbance may enter the amplifier coming from the remote voltage , through the built in remote wire and into the RCA cable. Thus we recommend to use a separate remote wire and run the RCA lead separate from remote wire, power cables and speaker cables.
You can either use a crimp fork terminal or insert the cable directly into the amplifier terminal. If there is no remote voltage available from the stereo, you must connect to the ignition key through the radio or any accessories fuse.

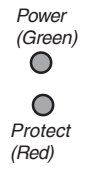
For High Level input:
We recommend you to connect the remote wire as described above.
The amplifier will be turned on/ turned off by the high level input voltage. This is done when the Hi level/Low level switch is set to Hi level position. There is a small disadvantage that this function gives soft turn on operation but some plop sound when switching off.
You do not have to connect any remote voltage when using Hi level input.



Power Light / Protect light

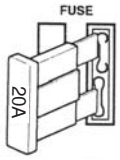
The power light (green) comes on when the amplifier is turned on.

The protect light (red) comes on when the amplifier shuts down from overheating or short circuit.

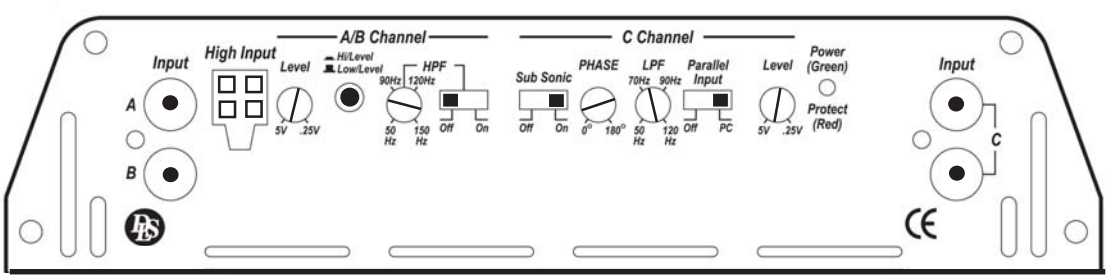


Fuses

Use only 20 ampere ATC blade type fuses. CAT31 uses two 20 ampere fuses.



Input and controls

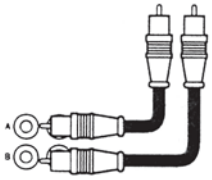


Input Wiring

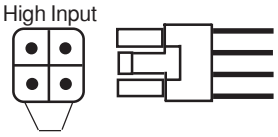
Inputs may be low level from the RCA output of the car stereo or high level from the car stereo speaker output.Low level = RCA is to prefer for the best sound quality.

Important
Use either the low level or the high level input, do not use both at same time.

Low level input
Use a pair of shielded stereo audio cables with RCA type jack. The cable length varies depending on type of vehicle. Most cables can be bought in lengths from 1 up to 5,5 meters.
Avoid placing the RCA cable close to speaker cables, power cables and remote control cable. Connect to input socket A & B.



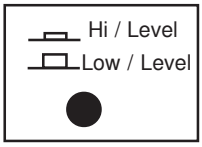
High Level Input
Connect left and right speaker wires coming from the car stereo to the high level input as shown. You must connect both plus and minus as the inputs are balanced, connecting plus only gives lower level and bad sound quality. By changing the polarity of plus and minus, you can change the phase.



White	:A ch.+
White/black	:A ch.-
Grey/black	:B ch.-
Grey	:B ch.+

Hihg level input socket.

Automatic turn on when using high level input.
With the Hi/Low input swich set to Hi, the amplifier turns on automatically on high input. You don´t need to connect a separate remote wire from your head unit.
When using High Level input:
Set the switch to position "Hi / Level"
When using Low level input:
Set the switch to position "Low / Level"
If the switch is set to wrong position, the amplifier still works, but the risk for disturbances or distortion increases.



Input Level control ch. A/B/C (Level)

The input level control, 5V – 0,25 V, matches the output of your radio to the input of the amplifier. After installation is complete, make sure the input of the amplifier is turned down all the way (counter-clockwise at 5V). Play a tape or CD, make sure all bass or treble settings or equalizer are flat, and turn the volume of the radio up until you just start to hear distortion. Turn the volume control down just a bit. On the amplifier increase the input level control (clockwise or to the right) until you just start to hear distortion, then back the level control just a bit. Now your radio and amplifier levels are matched.

Level

Subsonic filter ch. C

The **Subsonic filter** blocks the very deepest frequencies from reaching the subwoofers. The filter crossover is 25 Hz and can be disconnected.

Subsonic

Low pass filter ch. C (LPF)

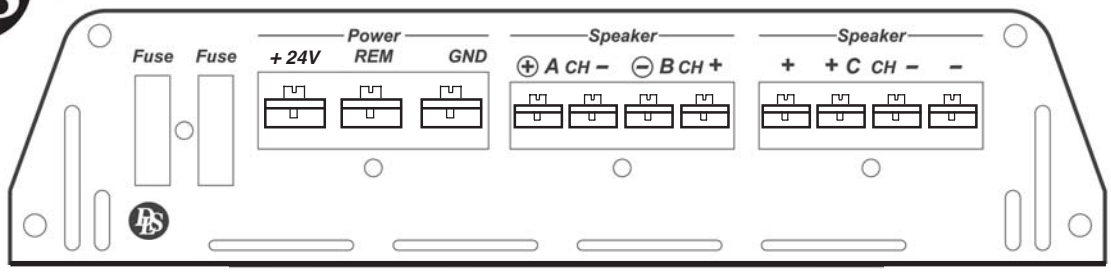
The **LPF** (low pass filter) allow low frequencies only and blocks higher frequencies. A typical setting is 60 – 80 Hz. Choose the setting that sounds best in your car.

LPF

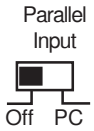
Phase control ch. C (PHASE)

The phase control can be set continuously from 0 - 180 degrees. This is very useful when you want to adjust the bass sound for best front stage image. Start on 0 and turn the control slowly clockwise until you experience the bass sound coming from the front.
You may have to change the polarity of the speaker connection to get the best result.

Phase

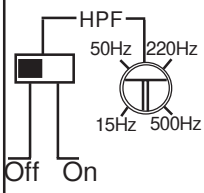


Parallel input



In position PC the signal is internally connected from input A/B to the input for channel C. A single RCA cable is enough to feed all channels. In OFF-position you must use dual signal cables or Y-splits.

High pass filter ch. A/B (HPF)



With the **HPF**-filter in **OFF** position the amplifier allows the speakers to play fullrange.
If you for some reason want to limit the low bass reproduction switch on the HPF-filter. The typical setting is then around 60 – 80 Hz.

Filter settings ch. A/B

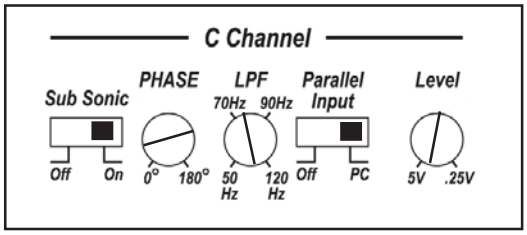
With the **HPF**-filter in **OFF** position the amplifier allows the speakers to play fullrange. If you for some reason want to limit the low bass reproduction switch on the HPF-filter. The typical setting is then around 60 – 80 Hz.

Filter settings ch. C

The subsonic filter takes away the very deepest frequencies. Turn on the subsonic filter if you want to remove these frequencis.

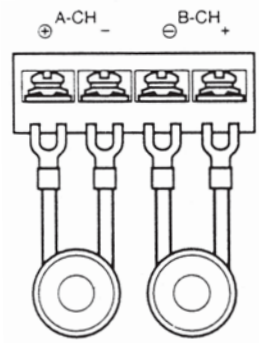
The **LPF** will allow low frequencies only and blocks higher frequencies. A typical setting is 70 – 100 Hz.

The phase control can be set continuously from 0 - 180 degrees. This is very useful when you want to adjust the bass sound for best front stage image. Start on 0 and turn the control slowly clockwise until you experience the bass sound coming from the front. If you dont get the result you want, also try to phase reverse the subwoofer connections and make a new adjustment.



Connection of front speakers

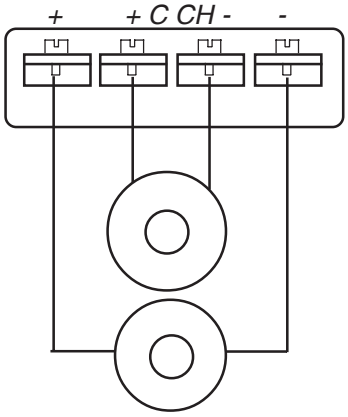
Two fullrange speakers connected to ch. A / B. CAT 31 can handle speaker loads down to 1 ohm per channel. You can connect four 4 ohm speakers in parallel on each channel.



Connection of subwoofers

One or two subwoofers to the sub channel (C).

You can connect two 4 ohm subwoofers on the sub channel without any risk for overload.

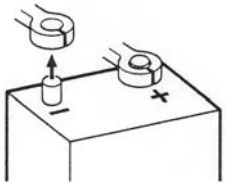


Testing

Before you finish the installation, you should do the following tests to make sure the wiring is correct and everything is operating properly.

Reconnect Battery

When wiring is complete, reconnect the battery negative terminal.



Test power wiring

1. Turn on the head unit but do not turn up the volume. The amplifier power light should come on. If not, check the remote and +24 volt wires. Also check the ground connection.
2. Turn up the head units volume slightly. All speakers should operate. if not, check wiring connections at amplifier and speakers.

Truck installations / Center channel speakers

The main differences between a sedan car for personal use and a truck are:
- 1 the wideness of the car and
- 2 the high noise level in a truck in motion.

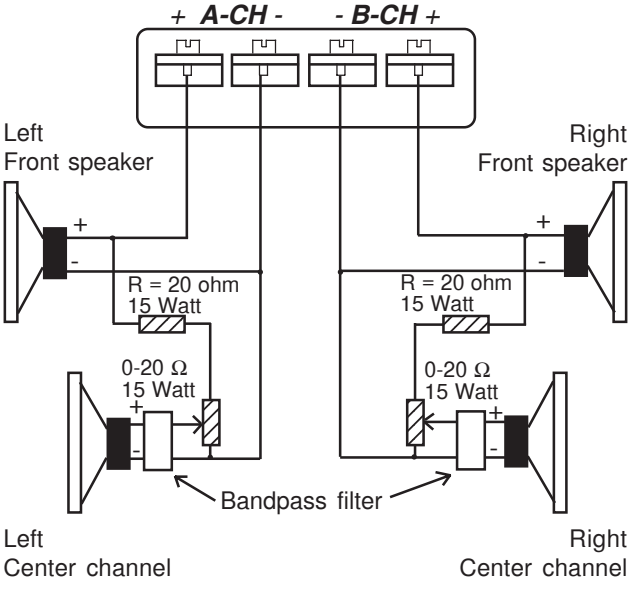
This makes it hard for the driver to listen to the right speaker (if the steering wheel is on the left) and for the passenger to hear the speaker on the drivers side.

Although a single driver can adjust the balance left right to compensate for this, a better solution is to add a center channel speaker / speakers.
Often you use a 4 or preferably a 5.25 inch speaker positioned at the center of the dashboard. Very often you use two speakers of reasons we will show later.

One center speaker connects to the left channel, but often at a lower level compared to the main speaker. The other center speaker connects likewise to the right channel. The two speakers together will thus play the sound of Left + Right.
This will fill in what you can call the gap in the soundstage of the earlier installation.
Your side system will hopefully be good 6,5 inch coaxes or two-way systems or even better. A small center channel speaker of smaller size will have to be feed at a lower level of volume and if possible through a band pass filter to limit the frequency response to say 500 - 6000 Hz.

Connecting two center channel speakers with bandpass filter

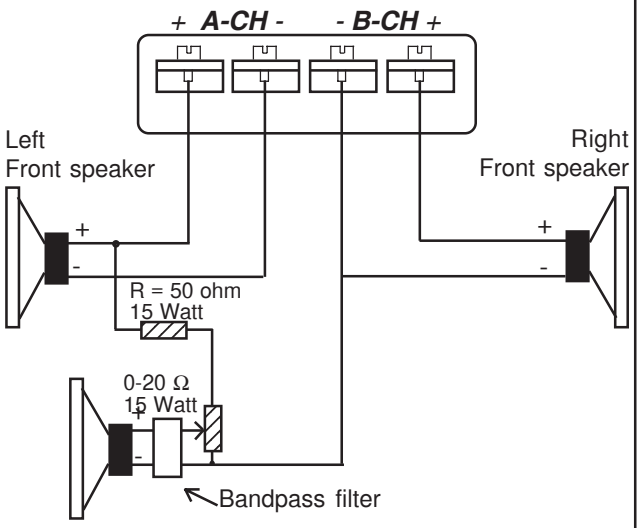
The drawing below show how to connect two center channel speakers to the CAT 31, through a voltage dividing circuit. Using a potentiometer you can adjust the volume from the speaker.
If you want to connect a bandpass filter, do so by using the filter design suggested on next page.



You can also use one speaker only, but connect it to the CAT31 amplifier in the bridge mode way. Thus the speaker will receive the Left + Right channel.
As this voltage is twice as high as what we feed to the left or the right speaker, we now must use a voltage divider or attenuator to bring down the power to what is suitable for the speaker.

Connecting one center channel speaker in bridge mode with bandpass filter

The drawing below show how to connect one center channel speakers to the CAT 31, through a voltage dividing circuit. Using a potentiometer you can adjust the volume from the speaker.
If you want to connect a bandpass filter, do so by using the filter design suggested on next page.



It is not necessary to use a bandpass filter, only if you want to limit the frequency range. The bandpass filter limits the frequency range from 500 to 6000 Hz.
On next page is a drawing if you want to build your own bandpass filter.

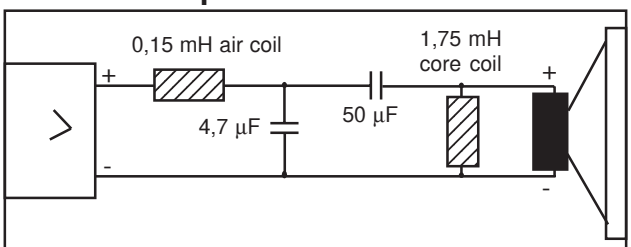
Center channel from car stereo head unit

If you don´t have any attenuators or bandpass filters available, there is a simple connection using the built in power of a 2 x 20 Watt or 4 x 20 Watt head unit. Although most headunits are refered to as 2 x 35 Watts or more, the true RMS power is normally 2 x 14 Watt in a four ohm load. The reason you buy an amplifier is to raise the available power to 2 x 75 Watt, roughly 5 times more. However as a sort of fill in the built in power can serve, as long as you do not push the car stereo into distortion.

The center channel speakers can be connected to say rear left and to rear right.
Using your fader control between front and rear you can adjust the volume of the center speakers in comparison to the main speakers feed from the amplifier The center channel speakers will produce 2 x 15 Watts.

Should you have one center speaker only, you can even connect it as above, but to rear left plus and to rear right minus. This way the speaker will reproduce Left + Right channel but only with 1 x 15 Watt.

Bandpass filter for 500 Hz - 6000 Hz for a 4 ohm speaker

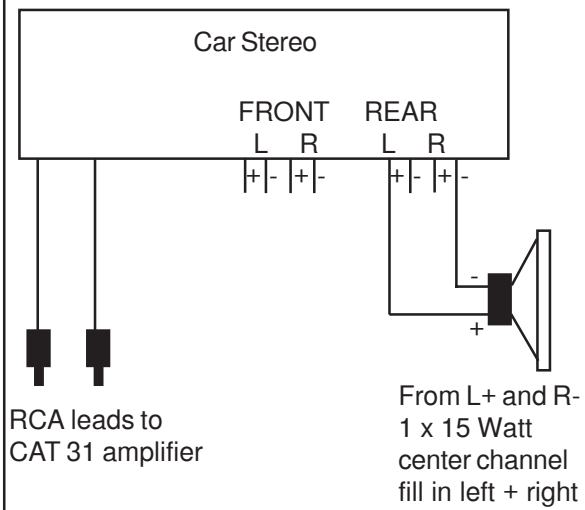


For 2 ohm speakers (two 4 ohm in parallell) or an 8 ohm combination (two 4 ohm in series) chose the values in this table.

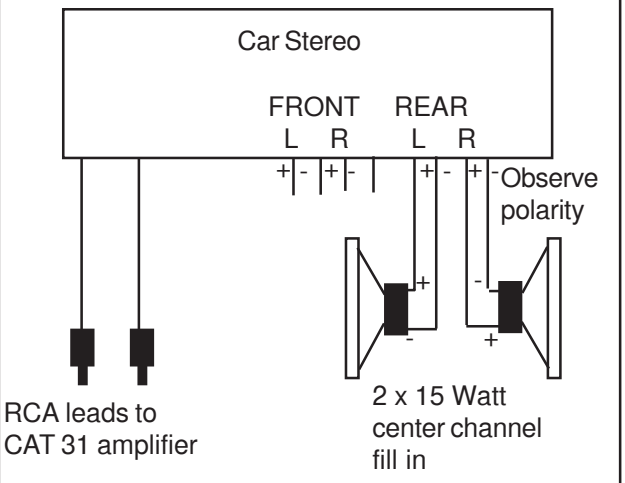
Spkr imp.	L1	C1	L2	C2
2 ohm	0,07 mH	10 µF	0,9 mH	100 µF
4 ohm	0,15 mH	4,7 µF	1,75 mH	50 µF
8 ohm	0,3 mH	2,2 µF	3,5 mH	25 µF

You can of course use two bandpass filters and connect one filter between the amplifier and each speaker.

Connecting one center channel speaker in bridge mode to rear output of car stereo head unit.



Connecting two center channel speakers to rear output of the car stereo head unit



Professional Tip:

NOISE PROBLEMS

WHINING NOISE VARYING WITH ENGINE REVOLUTIONS:

Do this:

1. Rewire the power supply (24 V) to source unit direct from battery.
2. Rewire ground wire from source unit to clean position on chassis.
3. Check all power connections to ensure that they are clean and tight.
4. Check quality of system ground connection.
5. Install a Power Cap capacitor. This can be helpful against most noise problems.

CONSTANT WHINING NOISE:

Do this:

1. Ensure that all equipment has a common ground point.
2. Check quality of earth strap connection from battery negative terminal to chassis.
3. Disconnect signal cables from amplifier to see if noise disappears. If so the leads are picking up noise. Test this by laying a new cable over the seats and reconnecting to the amplifier. If the noise does not return, re-route original cable away from source of interference.
   If noise remains regardless of cable position, try to use so called Quasi-balanced signal cables. DLS PRO or ULTIMATE cables are quasibalanced.

Professional Tip:

Installing in trunk
When installing the amplifier in the trunk, run the power wires along the same path as the other vehicle wiring. Many cars have insulated channels for wiring. you will have to remove the door sill trim and the carpet.

Professional Tip:

Crimp connections
Purchase crimp connectors and crimping tool. Connectors are color coded.

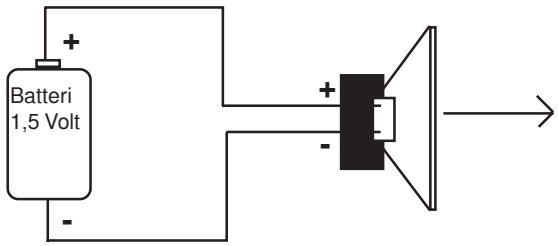
1. Strip 1/4 inch (6 mm) of insulation from the wire.
2. Insert into connector
3. Crimp tightly

Professional Tip:

SPEAKER POLARITY CHECK.

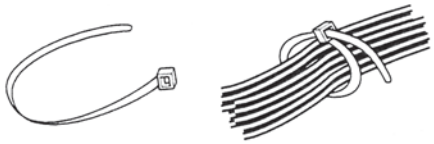
All speakers in a car audio system should be connected in phase (the same polarity). All speaker cones must move in the same direction. Out of phase speakers will cause a lack of bass, and a poor stereo soundstage.

Checking polarity:
Hold the - connection of the speaker wire to the - terminal of a 1,5 Volt flashlight battery. Tap the + wire on to the + terminal of the battery, and observe the movement of the cone. The cone should move outwards when the wire touches the battery, and inwards when the battery is removed. If it is the other way around, the speaker has been connected backwards and it must be removed and connected correctly.
If your system also has a subwoofer connected through a passive 6 or 12 dB crossover, try to connect this with various polarity and judge what sounds best. The phase shift in passive crossovers sometimes makes it necessary to change polarity.



Professional Tip:

Securing wires
Use wire ties to bundle together when possible. (But never bundle speaker wires or signal cables together with power wires.



Professional Tip:

Speaker and power wires
Do not run speaker and power wires next to each other. Power wires can generate a ”siren” sound in the speakers. Runs speaker and power wires on opposite sides of the vehicle.

Specifications

DLS Performance CAT31 - 24 Volt

Number of channels	3
Stereo Channels:	Ch A & B
RMS power out in 4 ohm (0,1% THD)	2 x 75 Watt
RMS power out in 2 ohm (0,1% THD)	2 x 145 Watt
RMS power out in 1 ohm (0,5% THD)	2 x 210 Watt
RMS power out in 4 ohm bridged mode	1 x 280 Watt
Filters high pass	50 – 150 Hz
Mono Channel:	Ch C
RMS power out in 4 ohm	1 x 170 Watt
RMS power out in 2 ohm	1 x 280 Watt
Filter subsonic	24 dB slope 25 Hz fixed* * can be switched in or out
Filter low pass	24dB slope 50 – 120 Hz
Phase control mono channel	continuous var. 0 – 180 degrees
All above output power ratings at 28V DC	
Input impedance, low level (RCA)	> 10 kohm
Input impedance, high level	100 ohm
Input sensitivity, low level (RCA)	0,25 – 5 V
Frequency range	10 Hz – 35kHz
Signal to noise ratio, A-weighted	> 90 dB
Power consumption, idle / max	0,7 A / 40 A
Fuses	2 x 20 A
Dimensions, mm	70 x 400 x 268
Dimensions, inches	2,92 x 15,75 x 10,55
Weight	4,8 kg / 10,58 lb
DC voltage range	24 – 30 V DC
Remote voltage range	12 – 30 V DC

We follow a policy of continuous advancement in development. For this reason all or part of specifications & designs may be changed without prior notice.

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